

printing" type ink jet printing method and apparatus (see FIG. 1 and col. 3, line 60 - col. 4, line 3). The printhead 20 has only two sets of ejectors and has a size substantially smaller than that of the substrate to be printed. The speed of this type of printing method and printer is dynamically limited by the sheer number of passes that the printhead must make to cover the substrate. Claims 1-40 recite a method and apparatus that are a substantial improvement over those described in Kneezel.

More importantly, each successive swath in Kneezel is deposited *such that it does not overprint the previously printed swath*. To illustrate, the color embodiment in Kneezel is described at columns 7 and 8 with reference to FIGS. 8-12. The color printhead 21 is divided into two sets of ejectors 111a and 111b. The two ejector sets are spaced from each other by the pitch distance 1.5d at the junction between the sets. Each set is further sub-divided into primary color sets of ejectors. The color sets are arranged as contiguous subsets or adjacent pairs along the linear array of each set.

It is important to note that Kneezel describes, at column 7, lines 55-62, that each particular ejector shown in printhead 21 is identified by a small primary color letter (c, m, y, k) within the printhead 21. In the illustrated embodiment, only two of each primary color ejector are shown within the printhead. However, Kneezel goes on to state that in a more practical version there may be approximately 24 to 32 or more ejectors of each primary color in each set in the printhead 21.

With reference to Kneezel FIG. 8, each ejector prints a distinct swath of *alternating spots of print* during each pass of the printhead. The plurality of ejectors also print in *alternating rows or swaths*. *Only the bottom row* shown in FIG. 8 represents a single pass of the printhead and shows the *alternating spots* printed by the first ejector k of the pair. The second from bottom row in FIG. 8 represents a next

subsequent pass of the printhead and shows the alternating spots printed by the second ejector k of the pair printed *in the open spaces between the spots printed by the first ejector k*. The rows between these swaths are not yet printed. These rows are printed by the second set of ejectors during much later printhead passes. Thus, any given printed swath in Kneezel cannot and does not overprint or register with the previously printed swath. The rows above the bottom two rows in FIG. 8 represent only much later subsequent passes of the printhead.

This is clearly described at column 8, lines 2-11. The printing procedure is the same for each color ejector and for each ejector set. Kneezel states that:

“the first k ejector in the printhead first places alternating spots of black ink in a particular horizontal row in the grid, while the next k ejector (second from the bottom) fills in the alternating spaces which were left by the first k ejector. Similarly, with the y, m and c ejectors, the first of each pair lays down alternating spots and the second of each pair fills in the spaces which had been left by the previous pass of the preceding ejector in the preceding pass (emphasis added).”

As seen from FIGS. 8 -11, the first of the k, y, m, and c ejector pairs lays down alternating spots in the same pattern, and the second of each pair only fills in the spaces between the alternating spots. As described at col. 8, lines 12-29, the second set of ejectors fills in the rows between the alternating swaths of print left by the first set of ejectors. In this way, Kneezel assures that many subsequent passes occur before any overprinting of a swath occurs. This is the antithesis of what is recited in claims 1-40.

Each of independent claims 1, 2, and 17 recites a limitation substantially similar to the following taken from claim 1:

“in a further relative traverse printing further swaths which at least partially overprint previously printed swaths in registry therewith, wherein each overprinting swath is of a different colour to the previously-printed swath which it overprints (emphasis added).”

The term registry is defined at page 1 of the present application. “Each dot may be overprinted by other dots in different colors superimposed in exact registry to build-up a color picture.” Though the overprinting dots may not be exactly superimposed, the dots may be deposited “in close proximity such that the visual effect is that of a single overprinted dot.” The successively printed dots in either case “are considered to be in registry with each other, each overprinted dot or group of proximate dots constituting a pixel.”

Kneezel does not teach or suggest at least this limitation of independent claims 1, 2, and 17. Accordingly, Kneezel taken alone does not disclose all of the limitations of claims 1-40.

Turning now to Kondo, this document first describes, with reference to *prior art* FIGS. 7 and 8, a prior art ink jet head that has “multiple nozzles for each colour to enable printing.” In the prior art FIG. 8, the nozzles are shown arranged in groups of four *adjacent nozzles of the same color*, each group being fed from a respective supply aperture 106. With reference to page 3, line 2 of the English translation, Kondo explains that the distance of head travel in this prior art head is *the print width plus twice the head width*. This is true only where there are no repeating blocks of color nozzles, and to insure that all colors are appropriately printed. Accordingly, in this prior art ink jet head, swaths can be printed which are larger than that produced by a single nozzle with the head traveling perpendicular to the nozzle row.

The prior art FIG. 8 head is similar to the prior art printhead described in FIG. 1a of the present application. FIG. 1a shows that the distance traveled by the printhead (20) is the length of the paper (12) plus twice the length of the printhead. This is quite distinct from the apparatus and method as claimed where the distance moved by the printhead is less than its length.

Kondo describes the problems associated with the necessary lengthy travel of the head in prior art FIG. 8. In this regard, Kondo mentions that "if the device is increased in size to achieve an increase in frequency, this causes the problem of increased drive noise when the head is returned." This is because, *since there are no repeating color blocks* in the FIG. 8 head, the travel distance of the larger head would still necessarily be the print width plus twice the head width. Kondo does not disclose a manner in which the size of the FIG. 8 nozzle arrangement could be increased.

Kondo then describes its with reference to FIGS. 1-6 *as a replacement for and to solve the problems of the prior art head in FIG. 8*. In the ink jet head of FIGS. 1-6 in Kondo, the nozzles are arranged *in a single row* of a plurality of units. Each of the units has four different color deposition nozzles. Page 4, lines 7-10 of the English translation describes that "the nozzles are, from the left, yellow 7Y magenta 7M cyan 7C and black 7BK, *forming one unit*, and the head comprises a row of multiple units." These units are then repeated and arranged in a single row of a single pixel width as is clearly shown in FIGS. 2, 3, 5, 9, and 10. Kondo fails to disclose, *for the invention in FIGS. 1-6 and 9-11*, to teach printing a single swath having a width greater than a width of a single nozzle element.

The head shown in FIG. 1 is shuttled back and forth a distance of only a single unit of nozzles, *but printing only a single swath at a time*. Thus, the head in Kondo

must still make many multiple passes to completely print the substrate. The apparatus of Kondo only attempts to shorten the head travel distance, not the number of passes made by the head. Kondo also fails to disclose any method of overprinting or registering successive swaths with previously printed swaths.

Only the prior art FIG. 8 discloses printing a swath bigger than a single nozzle and this is the prior art over which the present invention is an improvement. The official action purports to reject claims 1-40 based on the teachings of FIG. 2 (the invention of Kondo) and FIG. 8 (prior art). There is no suggestion or motivation within Kondo that these two distinct and mutually exclusive arrangements may be combined.

Kondo, as taken alone, fails to teach at least the same limitation of independent claims 1, 2, and 17 that is not taught by Kneezel, as discussed above. The combination of Kondo and Kneezel therefore does not render obvious claims 1-40, as the combination fails to teach all of the claim limitations. These claims are therefore in condition for allowance over the art of record.


CONCLUSION

According to the foregoing remarks, claims 1-40 are believed to be in condition for allowance. Reconsideration and allowance of the claims is hereby respectfully solicited.

The examiner is invited to contact the undersigned at the telephone number listed below in order to discuss any remaining issues or matters of form that will move this case toward allowance.

Respectfully submitted,

MARSHALL, GERSTEIN & BORUN
6300 Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606-6402
(312) 474-6300



Bryan J. Lempia

Reg. No. 39,746

Attorney for Applicant

November 14, 2001